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USSR Report

ENGINEERING AND EQUIPMENT

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USSR REPORT

ENGINEERING AND EQUIPMENT

No. 59

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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USSR

UDC 629.12.037.4

CONSTRUCTION OF DRIVE SHAFTS WITHOUT STRUTS TO REDUCE NOISE

Moscow SUDOSTROYENIYE in Russian No 3, Mar 79 pp 27-29

IZAK, G. D., POLYAKOV, A. A. and RASTORGUYEV, V. V.

[Abstract] As the propeller screws of a ship rotate, hydrodynamic forces act on them. The resulting noise vibrations are transmitted through the hull of the ship and radiated into the compartments. In double-screw vessels, most of the hydrodynamic forces are transmitted to the hull through the screw strut, which supports the dead wood tube in the vicinity of the end bearing. Screw drive shafts without struts were installed on river vessels planned by the Commercial River Fleet's Design Bureau: icebreakers with 600 horsepower engines and the high speed passenger catamaran "Anatoliy Uglovskiy," with a 2,000 horsepower engine. Noise reductions of up to 20 dB were achieved. A diagram of the installation is presented. The diameter of the dead wood tube must be increased to provide the strength ordinarily provided by the strut. Equations are presented for calculation of the stress and necessary strength increase of the dead wood tube when struts are not used. Figures 3.

USSR

STUDIES OF THE CENTRAL SCIENTIFIC RESEARCH INSTITUTE FOR THE MERCHANT MARINE IN THE AREA OF DEVELOPMENT OF NEW TYPES OF SHIPS AND FLEET ENLARGEMENT PROGRAMS

Moscow SUDOSTROYENIYE in Russian No 3, Mar 79 pp 55-56

MIROSHNICHENKO, I. P., USSR State Prize Laureate

[Article dedicated to the 50th Anniversary of the Central Scientific Research Institute of the Merchant Marine]

[Abstract] A survey is presented of the research in the area mentioned in the title conducted at the Institute over the past 50 years. Of particular interest is the work performed since the early 60's, when new trends appeared in the utilization of the fleet, requiring the construction of specialized ships of various types: large, high-speed vessels; specialized cargo vessels; broad-purpose cargo vessels; vessels using highly economical diesel and steam-turbine power plants, as well as gas turbines, all with increased automatic control. In 1971, a study was made of the directions of development of the cargo fleet and types of ships to be built in the last half of the decade.

The main trend in scientific progress for this period has been the specialization of the fleet in terms of the type of cargo transported, as well as areas of utilization, both technical and geographic. Based on the studies, in 1976 qualitative alteration of the fleet was begun, including: two types of large crude carriers (dw about 100,000 tons), three types of universal bulk cargo vessels (15, 25 and 45,000 tons), self-unloading cement vessels (8,000 tons), three types of very large crude carriers (100-150 and 300,000 tons), three types of general purpose tankers (5, 15 and 25,000 tons), the smaller two types adapted for Arctic travel, two types of gas carriers (7.5 and 30,000 tons). Other new types included a gas-turbine vessel with horizontal cargo loading and a container vessel capable of carrying 1,200 6.1 m containers and cruising at 25 knots.

USSR

UDC 621.822.573

ON THE POSSIBILITY OF OPERATING A HYDRODYNAMIC THRUST BEARING ON A WATER LUBRICANT UNDER INCREASED SPECIFIC LOADS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 3, Mar 9 pp 34-35

BOYARKO, N. N. and VAL'CHUK, V. K.

[Abstract] The operation of a thrust bearing using water as the lubricant (condensate at 40°C), containing 8 support cushions with an overall working surface area of 1,58.4 cm² was studied at a slip speed about the mean diameter of the cushions of 38.3 m/s. The excess lubricant pressure in the working chamber of the bearing cushions was maintained at about 0.03 MPa and the mass rate of flow of lubricating water through the working chamber of the bearing was 1.35 liters per second. The support disk was fabricated from 95 Kh18 steel with a roughness of Ra = 1.25 micrometers. An antifriction coating of S-1U was applied to the support faces and the load on the bearing was varied in steps in a range of 0--1.28 MN. The configuration of the bearing and the strain gages is shown and the average temperatures for the set of cushions are plotted as a function of the mean specific load on the bearing for two cases: where the cushions were supported by a lever equalizing system and also on a rigid base. A simple relationship is found between the hydrodynamic coefficient of friction and the mean specific load. It is concluded that support bearings with self-establishing cushions can operate with water lubricant at specific loads more than three times greater than the mean operational loads adopted for similar bearings with an oil lubricant; the S-1-U metal-fluoroplastic material operated reliably under the test conditions. Figures 5; references 4 (Russian).

USSR

UDC [007.52:621]:629.12

THE USE OF INDUSTRIAL ROBOTS IN MARINE MACHINE BUILDING

Moscow SUDOSTROYENIYE in Russian No 3, Mar 79 pp 41-43

YUR'EV, I. N., ISAYEV, O. F., KARPENKO, V. I. and SULIMOV, K. K.

[Abstract] One of the first steps in the direction of automation of production of marine machine building products is the Brig-10 industrial robot, for mechanization of simple loading and unloading operations involved in the servicing of lathes and press equipment. The Brig-10 is equipped with pneumatic drive and has cycle programmed control. It is modular in design, allowing it to be equipped with those sections necessary for performance of

specific operations in specific jobs. The machine is designed to be easy to use and easy to service. It has a maximum hoisting capacity of 10 kg, precision of positioning ± 0.3 mm, can move loads 100 mm vertically and 600 mm horizontally, with the "hand" capable of shifting left or right by 70 mm. Movement speeds are 300 mm/s vertically, 800 mm/s horizontally, 90° /s arm rotation. The overall size of the machine is 1,400 X 830 X 620 mm, and it weighs 275 kg. Photographs of the machine, reminiscent of a small antiaircraft cannon, are presented as it works in various situations. Figures 4.

USSR

UDC 551.46.073:551.463.21

DETERMINATION OF THE HEADWAY AND LEEWAY OF A SHIP BY AN ACOUSTICAL METHOD

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 293-295
manuscript received 25 Sep 78

VOLOVOV, V. I., KRASNOBOROD'KO, V. V., LYSANOV, YU. P. and SECHKIN, V. A.,
Institute of Acoustics, USSR Academy of Sciences

[Abstract] Earlier works have suggested a new acoustical method for determination of the absolute speed of movement of a ship, based on the simultaneous measurement of the coefficients of self- and mutual correlation of the fluctuations of the envelopes of sonic signals reflected from the bottom. However, the earlier results were based on the Kirchhoff approximation, which placed certain limitations on the conditions of applicability. In this work, these limitations are removed. Also, a method is given for determination of both the headway and the drift of a ship in addition to its absolute speed. Figures 2; references 7: 6 Russian, 1 Western.

USSR

UDC 531.383

STUDY OF A TWO-ROTOR GYROCOMPASS SUBJECT TO ROLLING

Leningrad PRIOROSTROYENIYE in Russian No 11, 1978 pp 75-80 manuscript received 18 Apr 78

POTEMKIN, A. E., Odessa Higher Marine Engineering School

[Abstract] A study is made of the influence of liquid and gas-dynamic friction upon rotation of the shell of a gyrosphere, as during the rocking of a ship. It is found that the elastic compliance present in a gyrosphere makes it a first-order system for rotation about the primary axis (NS in a gyrocompass). Rigidity of the system should not only be increased, but also the rigidity of the various parts of the support should be made equal in order to reduce the errors which result. Figures 3; table 1; references 7 (Russian).

USSR

UDC 534-14:535

GENERATION OF SOUND BY LONG LASER PULSES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 220-226
manuscript received 20 Mar 78; after correction 1 Jun 78

YEGEREV, S. V., YESIPOV, I. B., LYAMSHEV, L. M., NAUGOL'NYKH, K. A., Acoustical Institute, USSR Academy of Sciences

[Abstract] A study is made of the generation of sound by laser pulses striking the free surface of a liquid perpendicularly. Absorption of light in the surface layer causes heating of the liquid, which expands and radiates a sound wave. The dimensions of the area radiating the sound are determined by the radius of the laser beam and the path length of the light within the liquid, determined by the coefficient of absorption of the light. It is assumed that the intensity of the light is constant over the cross section of the beam. Equations are produced which relate the shape of the acoustical wave at some distance from the point of its emission to the shape of the optical wave which generates it. Oscillograms of acoustic and optical pulses are presented. The generation of sound by laser radiation in the long-pulse mode was also studied in a separate experiment. Figures 5; references 4: 2 Russian, 2 Western.

USSR

UDC 535.24.001

CALCULATION OF THE LUMINOUS FLUX LEAVING A HOLLOW CYLINDER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 6-7
manuscript received 26 Mar 78

BAUM, I. V. and BRASLAVSKAYA, M. V.

[Abstract] A basic theoretical problem in optical engineering is considered which relates to such practical problems as the performance of astronomical instruments and the illumination of space craft by light reflected from the earth. A hollow cylinder with absorbing walls is illuminated at one end by diffuse light from a spherical Lambert source. The luminous flux leaving this cylinder is calculated in the simple case where the axis of the cylinder extends through the center of the sphere. The space around the sphere is regarded as a black body at zero absolute temperature. An expression for the flux is derived by integrating with respect to the subtending solid angle, with the important geometric parameters being the ratio of sphere radius to distance between sphere and cylinder and the ratio of cylinder height to cylinder diameter. Various special cases such as that of a zero distance

between cylinder and sphere or that of the critical distance between them, at which the angle subtending the sphere is equal to the angle of vision through the cylinder, can all be evaluated on the basis of this expression. Figures 3; references 5: 4 Russian, 1 Western.

USSR

UDC 681.325.3

HIGH-PRECISION ONE-COORDINATE PHOTOELECTRIC CONVERTERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 8-9 manuscript received 11 Aug 78

MOSHKIN, V. I.

[Abstract] Photoelectric converters for the microelectronics industry are considered which consist of self-scanning linear (one-coordinate) multielement photosensor arrays. Their performance is analyzed on the basis of general expressions for the amplitudes of the output signals and for the overlap functions in such a linear array. Discretization lowers the precision of restoring the light intensity distribution along an array. The precision can be improved by a partial overlap in a geometric configuration which ensures a sequence of linearly independent overlap functions serving as a basis for a sequence of orthonormalized functions and leading to a system of linear equations much better approximating the measured light intensity distribution. The algorithm of solving this system of equations, i.e., of processing the signals is realizable on a digital computer with relatively little machine time required. Figure 1; references 2: 1 Russian, 1 Western.

USSR

UDC 621.396.2.029.67

AMPLITUDE ERROR OF AN OPTICAL RANGE FINDER DUE TO SIGNAL FLUCTUATIONS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 9-11 manuscript received 4 Sep 78

PLESHANOV, YU. V. and SAMOYLOV, V. D.

[Abstract] Fluctuation of the signal amplitude is a major source of error in locating the leading edge of a pulse on the time axis with an optical range finder. Such fluctuation occurs when, for instance, the emitted light beam shifts relative to the target surface and the received echo signal varies from pulse to pulse between a threshold level and some maximum level so that the error can become as large as half the pulse width. Here this error is calculated for a light beam with a gaussian radial intensity profile and normal distributions of independent vertical and horizontal shifts relative to a diffusely reflecting circular target surface. The probability density of the relative magnitude of the echo signal as well as the dispersion of the distance reading error are determined on this basis, while the mathematical expectation of this error is found to be zero. It thus becomes possible to estimate the accuracy of a range finder in the case of signal fluctuation. Figures 1; references 4 (Russian).

USSR

UDC 681.7.067.23

AN OBJECTIVE WITH A PLANOIDAL MIRROR

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 16-17 manuscript received 10 Apr 78

LUSTBERG, E. A. and PETROVA, L. A.

[Abstract] The wide-field aplanatic system developed by V. N. Churilovskiy is an analog of the Schmidt system. Its objective consists of a concave spherical mirror and an obliquely oriented planoidal aspherical mirror, with the tip of the latter located at the center of curvature of the former. Aberration of wide oblique light beams in high-speed lenses of this kind can be corrected only by shaping the planoidal mirror more intricately so as to make its plane of symmetry coincide with that of the axial light beam. With the retouch technology of aspherization already developed for prepolished flat quartz glass and with the manufacturing tolerances as well as their effect on the accuracy of the objective already established, a further experimental

study was made concerning the appropriate relative aperture of the objective, i.e., its ratio D/f' of diameter to focal length. The study shows the feasibility of producing an objective with the ratio $D/f' = 1:2.4$ ($D = 350$ mm) and a 2° field of vision. A scattering spot of $11'$ has actually been obtained, but its reduction to $3''$ appears possible. Figures 2; references 4: 3 Russian, 1 Western.

USSR

UDC 535.317.226

REALIZATION OF THE PRINCIPAL CHROMATICITY FACTORS IN COMPONENTS OF AN APOCHROMATIC PANCRATIC OBJECTIVE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 17-20 manuscript received 29 Mar 78

AGUROK, A. B.

[Abstract] On the basis of earlier derived equations for the principal chromaticity parameters of ideally thin and finitely thick components of an apochromatic pancratic objective, in this study the first component of such an objective in the form of a twin lens with an air interlayer of finite width is designed so as to realize the necessary chromaticity factors relative to two given spectral bands. The calculations follow the method of an equivalent lens with appropriate effective dispersion parameters. Errors are corrected as the design proceeds from that of a thin lens to that of a real thick one. Numerical data are given for several grades of glass as well as for CaF_2 and BaF_2 . The calculations can be extended to a first component in the form of a quad lens and to the other components of the objective. The calculations have been organized for automatic design on a computer. Figures 3; tables 1; references 5: 3 Russian, 2 Western.

USSR

UDC 535.231.11:535.317.61

ESTIMATING THE EFFECT OF SPHERICAL ABERRATION ON RADIATION LOSSES IN A
NARROW-FIELD OPTICAL RECEIVER SYSTEM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp
20-22 manuscript received 28 Jan 78

BALASHOV, I. F., VOZNITSKIY, M. V. and KORESHEVA, N. N.

[Abstract] An important factor in the design of photoreceivers with narrow-field optical systems for optical telemetry is the effect of spherical aberration in such a system on the radiation power loss in the receiver. Here this effect is estimated in a way which indicates how it depends on the width of the field of vision, on the radiation pattern of the radiator, and on departures of the photoreceiver axis from the direction of maximum signal reception. The spherical aberration is assumed to be mainly due to defocusing, with only a small third-order component. The ratio of power received to total power, both expressed in terms of the intensity distribution integral with appropriate limits, reduces to an algebraic expression. Numerical results with an allowance for error reveal that losses in the receiver can be reduced to negligible levels only as long as the misalignment angle between the optical axes does not exceed the field-of-vision angle of the receiver. The results also indicate the permissible size of the scattering spot, characterized by the ratio of its diameter to the field-of-vision angle. Figures 1; tables 1; references 5: 4 Russian, 1 Western.

USSR

UDC 681.785.552

A CUTOFF SYSTEM FOR FILTERING THE HIGHER ORDERS IN A SPECTRUM WITHIN THE 400-
200 cm^{-1} RANGE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp
41-44 manuscript received 10 Dec 78

OSSOVA, N. F. and KATSNEL'SON, P. Z.

[Abstract] IKS infrared spectrophotometers are now produced by the Leningrad optico-Mechanical Association which cover the 450-5000 cm^{-1} range of the spectrum, with interference filters for extraction of higher orders. Instruments with diffraction gratings, to extend the range to 200 cm^{-1} , require filters with an extremely low transmission of residual background radiation (10^{-4} - 10^{-8} at a 1% interference level). Both dispersion and Raman filters are being developed for this purpose, the latter type consisting of metallic gratings on

a polyethylene base (A. V. Mezenov and Yu. M. Shakunov) yielding so far better but not yet adequate results. Here a filter system is proposed which consists of two gratings on a polyethylene base with mutually perpendicular lines, a reflecting crystal (LiF , CaF_2 , or BaF_2 , depending on the band to be covered), and a dielectric coating directly on the scattering element in the spectrophotometer. The gratings are produced by the photoprinting method. Both transmission and reflection characteristics of such filters were measured and found to be entirely satisfactory. The simplicity of their construction, namely the small number of components, thus makes them particularly advantageous for use in modern spectrophotometers. Figures 4; tables 1; references 11: 8 Russian, 3 Western.

USSR

UDC 681.14(088.8)

A LASER DEVICE FOR RECORDING OF TRANSPARENCIES FOR HOLOGRAPHIC PERMANENT MEMORIES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 59-60 manuscript received 20 Jan 78

VALIS, A. S., KAUSHINIS, S. K., NALISHAUSKAS, M. A., MAL'DZHYUNAS, A.-A. YU. and RAGUL'SKIS, K. M.

[Abstract] Holograms for permanent memories are recorded with the aid of irreversible transparencies. Here such a recording device is described in which a metallic film is appropriately burned with a laser beam. This method yields a high contrast and ensures a uniform brightness of points containing information throughout a large number of holograms. It does not require separate chemical treatment and does not require a darkroom. The device consists of a nitrogen laser operating in the pulse mode, a rotatable mirror, a microscope objective, a feedback transducer, a position transducer, an illumination system with a set of lenses and prisms, and an array of indicator grids with photoreceivers. Automatic operation of this device in the reflection mode is possible. An information volume of 10^4 bits can be recorded within 0.1 h. Figures 3; references 3: 1 Russian, 2 Western.

RESOLVING POWER OF TRANSLUCENT SCREENS BASED ON LIQUID CRYSTALS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 61-62 manuscript received 21 Apr 78

LEBEDEV, V. I. and TOMILIN, M. G.

[Abstract] Translucent screens are used for viewing images under a microscope, in industry as well as in medicine, for which they must have a high resolving power. Here liquid crystals with the electro-optic effect of dynamic diffusion, transparent without a voltage and diffusing the light under a voltage above the threshold level, are considered for such screens. A screen like this consists of oriented liquid-crystal molecules (e.g., in a nematic mixture) filling the gap between two bonded plates of a transparent and electrically conducting material. Such screens with the gap ranging from 10 to 100 μm were evaluated on the basis of relative measurements of the resolving power and found to have excellent characteristics, depending in a not yet known manner on the layer thickness and on the voltage. Their main drawbacks are a limited temperature range (-15 to $+75^\circ\text{C}$), the technological difficulty of maintaining narrow gaps over large areas, and the inconveniences of requiring a voltage supply. Figures 1; tables 1; references 7: 6 Russian, 1 Western.

USSR

UDC 534.232

UNDERWATER EXPLOSION OF OXYHYDROGEN GAS WITH HIGH INITIAL VOLUMETRIC ENERGY DENSITY

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 265-270
manuscript received 9 Jun 78

MAKSAKOV, A. A. and ROY, N. A., Institute of Acoustics, USSR Academy of Sciences

[Abstract] An earlier report has noted that the efficiency of conversion of chemical energy to acoustical energy during underwater detonation of gaseous explosives can be significantly increased if the detonation takes place in an explosive gas precompressed to a pressure higher than the hydrostatic pressure and contained in a shell which is burst by the explosion. Additional information is presented in this article on the effectiveness of such explosions. In the experiments, gases were compressed to a pressure of about 1 MPa in shells of very small volume. Energy conversion efficiencies (for the total bubble) of as high as 36% are achieved. Figures 6; references 7 (Russian).

USSR

UDC 534.22

USE OF ACOUSTICAL FLOWS TO STUDY THE ABSORPTION OF ULTRASONIC WAVES IN A LIQUID WITH GAS BUBBLES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 296-297
manuscript received 17 Apr 78; after correction 9 Oct 78

CUR'EV, A. P. and SEMENOVA, N. G., Leningrad State University imeni A. A. Zhdanov, Physics Department; Scientific Research Institute of Physics

[Abstract] This work presents an experimental study of the concentration dependence of absorption of an ultrasonic field in a liquid containing gas bubbles. The method of acoustical flow utilizes the linear relationship between the local velocity of a stable acoustical flow, the coefficient of absorption of sound and the local intensity of the acoustical wave. Proper determination of the coefficient of absorption of sound in a medium by the method of acoustical flows requires measurement of the speed of the flow on the acoustical axis of the radiator, achievement of a stable, laminar acoustical flow mode, creation of a flat traveling wave field in the vessel in which the study is being performed, and elimination of reflected waves. A figure

presents results of measurement of the absorption of sound in glycerin containing bubbles of air and gas concentrations $3 \cdot 10^{-4}$ to $4 \cdot 10^{-2}\%$, showing that the coefficient of absorption of porous glycerin is higher than that of nonporous glycerin by more than an order of magnitude. Figure 1; references 3 (Russian).

USSR

UDC 533.697.3

AERODYNAMIC STUDY OF A PLANE MULTICHANNEL SUBSONIC DIFFUSER

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, MASHINOSTROYENIYE in Russian No 3, 1979 pp 54-58 manuscript received 4 Sep 78

KIRILENKO, D. A., Graduate Student, and PANKOV, O. M., candidate of technical sciences, Moscow Higher Technical School imeni N. E. Bauman

[Abstract] Results are reported from an aerodynamic study of a flat, five-channel subsonic diffuser with no boundary layer control. The studies determined the coefficient of restoration of the pressure, the total loss coefficient, the coefficient of restoration of energy and the adiabatic efficiency of the diffuser. It was found that the wakes downstream from the diffuser vanes were equalized at a distance of 3-8 d from the exit cross section. Visualization of the flow showed that the commonest type of flow separation was separation of the flow at rectangular corners. Figures 3; table 1; references 5 (Russian).

HEAT EXCHANGE IN TURBULENT GAS STREAMS WITH HIGH FREQUENCY PRESSURE FLUCTUATIONS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, MASHINOSTROYENIYE in Russian
No 3, 1979 pp 72-77 manuscript received 2 Mar 77

GALITSEYSKIY, B. M., doctor of technical sciences, associate professor

[Abstract] A study was performed to determine the conditions under which the maximum intensity is achieved in the process of heat exchange upon resonant oscillations of a turbulent gas stream in the channels of the heat exchanger. The experiments were performed in cylindrical channels 12 to 29.4 mm in diameter and 2.045 to 3.4 m in length. The temperature of the flow was varied from 350 to 700 K, channel wall temperature from 500 to 800 K, Reynolds number 10^4 - 10^5 , pressure in the channel 3.5-20 atm, oscillating frequency 20-1,000 Hz, oscillating amplitude 0.1-3 bar. It was found that the vibrations of the gas flow have a significant influence on the structure. The pulsating movement has some of the properties of a boundary layer. Measurement of the spectrum of regular oscillations showed that the flow is restructured as it approaches the wall: the oscillations of the fundamental frequency decrease in amplitude, while the higher harmonics increase in amplitude. Figures 3; references 4 (Russian).

USSR

UDC 534.833.5

SOUND INSULATION OF CYLINDRICAL SANDWICH SHELLS WITH EXCITATION FROM WITHIN

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 197-202
manuscript received 30 Jun 78

BESHENKOV, S. N., COLOSKOKOV, YE. G. and KLENOVA, L. M., Khar'kov Polytechnical Institute imeni V. I. Lenin

[Abstract] A study is made of the sound insulation of a cylindrical sandwich shell of asymmetrical structure with arbitrary parameters of the filler, when struck by an acoustical wave from within. Equations from the dynamic theory of elasticity are used to describe the movement of the filler in response to the incident acoustical wave. Conditions are described under which the impedance becomes equal to 0 and the sound passes freely through the shell at a certain critical frequency. At frequencies above this frequency of circular resonance, the sound insulation of the shell can be calculated by the equations for sound insulation of a plate, except for certain narrow areas near the resonant frequencies of the column of air within the cylinder. Figures 3; references 11: 10 Russian, 1 Western.

USSR

UDC 539.3:534.1

BENDING OF A SHELL OF DUAL CURVATURE IN THE VICINITY OF AN ELLIPTICAL LOADING AREA

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, MASHINOSTROYENIYE in Russian No 3, 1979 pp 8-11 manuscript received 27 June 77

OL'SHANSKIY, V. P., candidate of technical sciences

[Abstract] When normal local loads act on gently curved shells the stress state which arises is primarily one of flexure. Therefore, this article studies only bending moments, and assumes that the local stress state depends little on the boundary conditions, allowing an infinite two-dimensional Fourier transform to be applied for the solution. Simple asymptotic equations are produced for calculation of the moments desired. Tables 2; references 4 (Russian).

FORCED OSCILLATIONS OF DRIVE SHAFTS DUE TO DEFECTS IN COUPLINGS

Moscow MASHINOVEDENIYE in Russian No 2, Mar/Apr 79 pp 29-35 manuscript received 21 Dec 76; revised 19 Oct 77

POZNYAK, E. L., Moscow

[Abstract] This work is a logical continuation and development of an earlier work by the same author, gives a qualitative analysis of the influence that defects in zero-play couplings have on vibration, and presents a sequence for consideration of such imperfections in the calculation of the vibrations of isotropic rotors. An example of calculation of a four-bearing drive shaft is presented. The calculation of the example was performed on a Minsk-22 computer, and showed that both transverse and angular defects in manufacture and assembly caused vibration over a broad range of frequencies, with the maximum of vibration arising at critical speeds. Figures 3; references 10 (Russian).

USSR

UDC 534+534.231.2

THE OPERATION OF A HORIZONTAL LINEAR ANTENNA IN AN AQUEOUS LAYER

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 227-233
manuscript received 10 May 78

YELISEYEVNIN, V. A., Institute of Acoustics, USSR Academy of Sciences

[Abstract] A study is made of the directionality of a horizontal linear acoustical antenna located in a layer of water with an antenna length comparable to or greater than the thickness of the layer of water. For simplicity, the layer is assumed to be homogeneous, plane-parallel, with absolute reflecting boundaries (surface absolutely soft, bottom absolutely rigid). As the length of the antenna increases, with unchanged propagation conditions, the width of the main maximum of the directionality pattern decreases. Figures 4; references 4 (Russian).

USSR

UDC 534.833

ESTIMATION OF THE EFFECTIVENESS OF VIBRATION-ABSORBING COATINGS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 245-250
manuscript received 2 Dec 77; after reworking 8 Sep 78

KANAYEV, B. A. and TARTAKOVSKIY, B. D., Institute of Acoustics, Academy of Sciences, USSR

[Abstract] A study is made of the influence of changes in the dynamic parameters on the effectiveness of a vibration-absorption coating, determined from the decrease of the mean square of vibrational velocity within a structure for the general case, in which the effectiveness of the coating depends on the relationship between the impedance of the source and the input impedance of the structure, which changes when the coating is applied. Based on the equations thus developed, a method is produced for estimating the effectiveness of coatings applied to actual structures with input impedance or input conductivity that can be determined experimentally. The equations for the effectiveness of coatings which are produced can be used to estimate the effectiveness of decreasing the level of vibrations of structures in various oscillating modes, and also for the selection of the type and parameters of vibration-absorbing coatings which will be most effective under the operating conditions of the specific structure in question. Figures 4; references 4 (Russian).

USSR

UDC 621.319

SPACE-TIME PROCESSING OF ACOUSTICAL SIGNALS IN WAVEGUIDES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 251-257
manuscript received 17 Apr 78; after correction 7 Sep 78

KARNOVSKIY, A. M. and KRASNYY, L. G.

[Abstract] This work is dedicated to the synthesis and analysis of both optimal and nonoptimal algorithms for space-time processing of signals propagating through waveguides, considering their modal structure. Several calculation examples are presented. The studies show that the interference stability of antennas operating in waveguides differ significantly from the corresponding characteristics of the antennas in free space, which must be considered in planning. Figures 5; references 9 (Russian).

USSR

UDC 534.286

INTERNAL LOSSES IN METAL EXPOSED TO BENDING ULTRASONIC OSCILLATIONS OF HIGH INTENSITY

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 25 No 2, Mar/Apr 79 pp 258-264
manuscript received 23 Aug 77; after revision 31 Jan 78

KULEMIN, A. V., Central Scientific Research Institute for Ferrous Metallurgy
imeni I. P. Bardin

[Abstract] A study is made of internal friction as a frequency of flexural oscillations of 17.0-18.0 KHz in type 12Kh18N9T stainless steel, deformed by drawing from a radius of 20 mm to a radius of 8 mm, as well as polycrystalline aluminum, copper and nickel, all at least 99.9% pure, deformed by bending by about 10%. The coefficient of internal friction is determined by using an equation obtained by solution of the thermal problem for a rod of resonant length. The flexural oscillations apparently result in the appearance of transverse nonconservative motion of dislocations, greatly increasing the absorption of energy at ultrasonic frequencies with amplitudes of the oscillations of 10^{-3} - 10^{-4} mm at temperatures below 100°C. Figures 3; references 9: 8 Russian, 1 Western.

USSR

UDC 620.191.31

SPECTROSCOPIC AND MASS-SPECTROSCOPIC SURFACE EXAMINATION OF COPPER MIRRORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 4-6 manuscript received 14 Aug 78

BALAKOV, A. V., GRAVEL', L. A., KONSHINA, YE. A., MORICHEV, I. YE., SAVINOV, V. P. and SEMENOV, YE. P.

[Abstract] Metallic mirrors, particularly copper mirrors, are widely used in laser optics because of their excellent reflection characteristics and resistance to the effects of radiation pulses. Here a study was made to determine the surface condition attainable by various methods of polishing. The specimens were cut and polished without grinding to a nominally class-13 finish. Their surface was then examined by infrared spectroscopy and electron-induced desorption, also under a raster-type electron microscope. The results indicate that buffing with a paste leaves in the defective surface layer a residual amount of nonmetallic, organic molecules which may be forming hydrocarbon-copper complexes. Such conventional polishing requires an additional cleaning with an electron beam in vacuum. Much better results are obtained by diamond honing or ionic polishing. Figures 3; references 6: 4 Russian, 2 Western.

USSR

UDC 535.853.26

A SPECTROPHOTOMETER FOR SEQUENTIAL MULTIELEMENTAL ANALYSIS OF A SUBSTANCE ON THE BASIS OF ITS ATOMIC SPECTRA

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 23-26 manuscript received 17 Aug 78

SUBOCHEV, A. I.

[Abstract] A spectrophotometer for multielemental analysis of substances on the basis of their atomic spectra by the most expedient method, namely programmed sequential tuning of the monochromator with the aid of a control computer, has been developed which includes several new features. A slotted dissector makes it possible to raise the signal modulation frequency so that periodic scanning becomes a more effective means of improving the accuracy of line detection. A step motor with a pulse distributor replaces a synchronous motor with speed reduction through gears. A digital voltmeter is sequentially connected through a commutator to all spectral-line channels and the background-noise channel. The instrument has been specially tested for accuracy, resolution and spectral range. Its performance characteristics are excellent and, furthermore its cost is relatively low. Figures 3; references 7: 2 Russian, 5 Western.

A SPECTROSENSITOMETER FOR PHOTOCHROMIC MATERIALS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 26-28 manuscript received 20 May 78

GRACHEVA, L. V. and PESHKOV, N. M.

[Abstract] Various applications of photochromic materials reversibly changing color under the influence of visible light require that their spectral-kinetic characteristics be known. These characteristics include darkening kinetics and isothermal relaxation as well as dependence of the light-induced additional optical density on time and on the wavelength of incident light. Here a method of measuring these characteristics is described which combines better accuracy with higher sensitivity than angular staggering of two light beams in space. The activating light beam and the measuring light beam are alternately turned on a specimen of photochromic material, both normally incident. The dependence of additional optical density on the wavelength of activating light reveals the spectrum of color center formation, while its dependence on the wavelength of the measuring light reveals the spectrum of additional absorption. This method of periodic measurement has been tested on photochromic glasses FKHS2,3,4 with a special spectrosensitometer consisting of both optical and electrical components. This method eliminates vignetting and additivity errors, it also simplifies the measurement of incident energy. Figures 4; references 15: 9 Russian, 6 Western.

OPTICAL PROPERTIES AND RADIATIVE STABILITY OF THIN PLATINUM FILMS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 29-30 manuscript received 10 Sep 78

BAUTIN, A. V., POLYAKOV, YU. A., SAFRONOV, V. I. and SHILYAYEV, A. A.

[Abstract] Thin platinum films serve as nonselective radiation receivers for operation with gaseous CO₂ lasers (10.6 μ m wavelength), their main features being fast response and long life. Here the optical properties, namely the transmission coefficient and the reflection coefficient of platinum films 600 Å and thicker, pure and with platinum black, as well as the transmission coefficient of platinum black alone were determined with the aid of IKS-14, SFD-2, UR-20 and Hitachi TD spectrophotometers covering the 0.5-14 μ m range of wavelengths. For control, measurements were also made with an

FMSH-40M photometer and a set of light filters. These films had been deposited on KBr and glass substrates. The results indicate fairly flat characteristics of both coefficients over this range of the spectrum. The effect of radiation on the stability of such films and on their optical characteristics was measured with pulses from a commercial GOS-30M laser. Platinum films without coating were found to acquire a crystalline structure upon exposure to radiation energy higher than 1 J/cm^2 . Pulses of 300 μs duration delivering over 10 kW/cm^2 caused the films to break down after a temperature about 1100°C had been reached. However, it is the melting point of substrates (about 800°C) which limits the performance of such radiation receivers. Figures 3; references 3: 1 Russian, 2 Western.

USSR

UDC 535.345.6-3:666.1.056

COATINGS FOR COMPONENTS USED IN NONLINEAR OPTICS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 31-33 manuscript received 25 Jan 78

SUKOLOVA, R. S., YEGORENKOVA, I. V. and RAZUMOVSKAYA, N. A.

[Abstract] A study was made of optical coatings produced chemically by deposition of thin films (titanium and silicon oxides or thorium and silicon oxides) from a solution, to serve as mirrors, selective reflectors, or transparencies in frequency doubling systems. A wide range of optical characteristics, namely maximum and minimum reflection coefficients at various desirable wavelengths, were obtained by appropriately compounding as many as 13-19 layers of different optical thicknesses. It was found possible to maintain close tolerances on the refractive index and to thus accurately match the required design characteristics. Figures 3; tables 1; references 9: 7 Russian, 2 Western.

USSR

UDC 681.7.068.4

IMPROVING THE VACUUM TIGHTNESS OF SINTERED FIBER-OPTICS PLATES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 34-36

PETROVSKIY, G. T., POLUKHIN, V. N. and SOKOLOVA, T. V.

[Abstract] The use of optical-fiber plates as input and output screens for image converters ensures excellent performance characteristics of these devices, but they must be as vacuum-tight as monolithic glass plates. One method of sealing is impregnation with concentrated solutions of compounds which, upon heating, decompose into a solid filler and escaping gaseous products. Here this method was tested with aqueous solutions of $\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$ and $\text{AlNO}_3 \cdot 9\text{H}_2\text{O}$, the plates being subsequently treated some according to standard procedure and some according to a less stringent procedure including sintering at 500°C in both cases. The results indicate that the effectiveness of impregnation does not depend on the pressure and that impregnation with $\text{Na}_2\text{SiO}_3 \cdot 2\text{H}_2\text{O}$ under low pressure eliminates both small and large leaks. Impregnation with $\text{AlNO}_3 \cdot 9\text{H}_2\text{O}$ has not produced successful results.

The authors thank A. V. Kiyko, V. K. Volkov and L. N. Ryzhik for the assistance in this study. Tables 1; references 10: 5 Russian, 5 Western.

USSR

UDC 661.1.053.512

CAUSES OF FOAM FORMATION AND METHODS OF FOAM SLAKING WHEN POLISHING ALKALI-SILICATE GLASSES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 36-38 manuscript received 20 Jan 78

SOLOV'YEV, A. I. and KHODAKOV, G. S.

[Abstract] A study was made of foam formation during polish treatment of K8 optical glass with rosins containing organic acids of the $\text{C}_{19}\text{H}_{29}\text{COOH}$ composition. The liquid phase of the suspension forming on the surface was examined for resin and soap content, extraction with carbon tetrachloride and by quantitative infrared analysis. According to the results of this experiment, foam formation follows adsorption of soap by the solid particles in the suspension and stabilizes at very low concentrations, i.e., during the initial stage of polish treatment. Successfully tried as possible remedies were

oxalic acid, a noncorrosive and nonvolatile soap solvent, or boosting the soap concentration to levels at which reversal of hydrophobization would occur. Figures 3; tables 1; references 7: 5 Russian, 2 Western.

USSR

UDC 53.082.54

AN INSTRUMENT FOR MEASURING THE STRAIGHTNESS OF CYLINDERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
p 56 manuscript received 14 Mar 78

KARTASHEV, A. I. (deceased), FRUDKO, T. F. and ETSIN, I. SH.

[Abstract] A prototype instrument has been built at the All-Union Scientific Research Institute of Metrology imeni D. I. Mendeleyev which allows measuring the straightness of high-precision cylinders, or rather 1-3 μm deviation from straightness, with an error not exceeding 0.03 μm . It consists of a KIM12-100 lamp, a condenser, a shutter, two objectives, a light-beam splitter, a reference plate, a Dove prism, a monochromator, a cassette and an electric motor turning the tested cylinder together with the plate. The measurement error depends mainly on the surface finish of the reference plate. Cylinders up to 300 mm long can be inspected with this instrument. The authors thank A. N. Korneva for making such measurements with this instrument. Figures 2; references 2 (Russian).

USSR

UDC 531.43

FRICTION FORCES GENERATED DURING VACUUM POLISHING

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79
pp 57-58 manuscript received 20 Mar 78

SHKEROV, YU. V.

[Abstract] A test stand including a d.c. motor with a V-belt drive was built for studying and measuring the friction forces generated during grinding and polishing. Metal parts were polished inside a vacuum chamber (10^{-5} torr) with silica gel serving as the abrasive-adsorbent material. Tangential and normal friction forces were measured during such a treatment controlled by a special mechanism. Friction ellipses in the normal-tangential force

plane were recorded with the aid of strain gauges mounted orthogonally on the cylindrical surface of the polisher chuck and connected into two bridge circuits feeding respectively the horizontal deflection and the vertical deflection and the vertical deflection of an oscillograph. The friction ellipses were found to become larger after longer duration of the polish treatment, but to remain much smaller in vacuum than in air. Figures 3; references 7: 5 Russian, 2 Western.

USSR

UDC 539.216.2:535

DECREASING THE DIFFUSION OF LIGHT AND THE REFRACTIVE INDEXES OF METALLIC-OXIDE LAYERS PRODUCED BY CATHODIC AND RF SPUTTERING

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 79 pp 58-59 manuscript received 22 Mar 78

MATSKEVICH, L. L. and CHERNYAVSKIY, V. A.

[Abstract] The excessive diffusion of light in TiO_2 , Ta_2O_5 , Nb_2O_5 , ZrO_2 and other metallic-oxide thick films produced by cathode sputtering can be decreased by interspersing of their layers, whose refractive indexes are high, with SiO_2 (quartz) layers from a separate target. Here a better method of decreasing the diffusion of light without increasing the refractive index or decreasing the refractive index without increasing the diffusion of light is described which involves film deposition from a cold oxygen plasma, excited by an rf electromagnetic field, where chemical compounds decompose. Quartz films are thus produced by decomposition of tetraethoxysilane or other alkoxy compounds. This method improves the manufacturability of multilayer interference coatings and, furthermore, allows a smooth regulation of the refractive index by appropriate variation of the pressure of the added substance. One difficulty to be overcome, however, is the instantaneous polymerization of such vapors (tetraethoxytitanane vapor, for instance, added for the purpose of increasing the refractive index) as they enter the sputtering chamber. Tables 1; references 3: 2 Russian, 1 Western.

USSR

UDC 620.1/9.16.08

A MULTIPURPOSE ULTRASONIC LEAK DETECTOR

Moscow SUDOSTROYENIYE in Russian No 3, Mar 79 pp 43-46

BURIN, V. N. and BURIN, S. YU.

[Abstract] Ultrasonic leak detectors have recently been developed, based on recording of the acoustical oscillations of equipment or the air or water around the equipment, caused by the passage of air, water or other substances through leaks. A description and schematic diagram are presented of a contact leak detector made with microcircuits type 1UT401B. The device includes an intensimeter to determine the quantity of statistically distributed electrical signals received by the piezoelectric transducer per unit time exceeding a certain trigger level. This is used to distinguish the noises caused by leaks from the noises caused by ordinary operation of the machine. The technical characteristics of the leak detector are listed. Figures 4; references 6: 5 Russian, 1 Western.

USSR

UDC 621.833:621.892.92

THE OPERATIONAL PERFORMANCE OF GEAR DRIVES WITH MAGNETIC POWDER LUBRICATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 3, Mar 79 pp 12-15

MYISFEL'D, L. O., DROZDOV, YU. N., KEMURDZHIAN, A. L., PAVLOV, V. G. and ROZENTSVEYG, I. I.

[Abstract] The wear and service life of a cluster gear made of S-5F and a working gear pair made of KZh-4F sintered ferroglass materials were tested in a special stand for the following conditions: with and without MoS₂ powder lubricant in air at 760 torr, in a vacuum of $5 \cdot 10^{-5}$ -- $5 \cdot 10^{-6}$ torr and in a medium of 98.5% CO₂ at a pressure of 5 -- 10 torr. The gear wheels were run for 500 hours, and checked every 100 hours. The rotational speed of the cluster gear was 750 r.p.m. and the working gears ran at 520 r.p.m. The roughness parameter of the working surfaces of the teeth, in Ra, ranged from 2.5 -- 1.25 micrometers and the maximum contact stresses were 6,000 kgf/cm². The solid magneto-active lubricant was a mixture of molybdenum disulfide and nickel powders in a volumetric ratio of 3:1. The magnetic induction in the gap between the magnet pole and the wall of the reduction

gear was $B = 300\text{--}500$ gauss. Magnetic powder lubrication permitted a reduction in the wear of 8 to 10 times, and a visual inspection of the reduction gear after 500 hours showed that the gear wheels were still in good condition and could continue in service. The rate of wear is plotted graphically as a function of time as is the efficiency of the gear pair of the reducer. The greatest wear was noted in air while the least wear was observed in a vacuum. A planetary reduction gear was also tested, where the epicyclic reducer gear was made of V-95T aluminum alloy and the teeth were surface hardened by anodizing. The remaining gears were fabricated from C-5F metal ceramic material. The same solid lubricant was used as in previous cases and the reducer was tested in a vacuum of down to $5 \cdot 10^{-6}$ torr in a range of temperatures of $100\text{--}250^\circ\text{C}$. After 600 hours, $10\text{--}20$ micrometers of wear was detected in the epicyclic gear, where a reducer operating under the same conditions without lubrication exhibited the same wear after 100 hours and with MoS_2 solid lubricant alone, after 200 hours. Figures 4; references 3 (Russian).

USSR

UDC 620.179.16:620.111.3

AN APPARATUS FOR THE STUDY OF THE PHYSICAL AND MECHANICAL PROPERTIES OF MATERIALS BY THE METHOD OF ACOUSTICAL EMISSION

Moscow ZAVODSKAYA LABORATORIYA in Russian Vol 45 No 3, 1979 pp 240-241
manuscript received 23 Nov 77

ZHURAKOVSKIY, L. A., KOROTCHENKO, YU. I., UZENBAYEV, F. G. and CHICHILANOV, V. V., Orenburg Polytechnical Institute

[Abstract] The authors have developed a system of hardware for the measurement and recording of acoustical emission signal parameters, allowing certain physical-mechanical properties of materials to be determined. The system includes an electronic recording oscillograph, a pulse counter, and a strip-chart recorder. The method of operation of the system is briefly described. The system was used to study several steel alloys and one titanium alloy, and a correlation was found between the acoustical emission signals and the yield point. Figures 3; references 3 (Russian).

USSR

UDC 669.14:620.179.16:620.174

USE OF ULTRASOUND TO RECORD THE MOMENT OF INITIATION OF FAILURE FOR DETERMINATION OF THE CRITICAL VALUE OF THE I-INTEGRAL

Moscow ZAVODSKAYA LABORATORIYA in Russian Vol 45 No 3, 1979 pp 266-268
manuscript received 31 Jan 78

ANDROSOV, A. P., DEYCH, A. SH. and KOPEL'MAN, L. A., Leningrad Polytechnical Institute

[Abstract] The ultrasonic method is used to test the breaking toughness of specimens of steel $10 \times 10 \text{ mm}^2$ in cross section. The steel used has a yield point of 60 kgf/mm^2 . Processing of loading diagrams of five specimens according to the method suggested by Rice and Paris [ASTM STP 536, 1973] yielded a mean value of I_{1c} of $13.0 \text{ kgf}\cdot\text{mm/mm}^2$, $\pm 4\%$. This indicates that the use of the ultrasonic method is quite sensitive and promising for toughness testing under conditions such that plastic deformation is well developed.

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